Electropneumatic Positioner
Type 3730-0



Fig. 1 · Type 3730-0

Mounting and Operating Instructions

EB 8384-0 EN

Edition February 2005

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General safety instructions

- *The positioner may only be assembled, started up or operated by trained and experienced personnel familiar with the product.*
  According to these mounting and operating instructions, trained personnel is referred to as individuals who are able to judge the work they are assigned to and recognize possible dangers due to their specialized training, their knowledge and experience as well as their knowledge of the relevant standards.
- *Explosion-protected versions of this positioner may only be operated by personnel who have undergone special training or instructions or who are authorized to work on explosion-protected devices in hazardous areas. Refer to section 7 on Servicing explosion-protected versions.*
- *Any hazards that could be caused by the process medium, the operating pressure, the signal pressure or by moving parts of the control valve are to be prevented by means of the appropriate measures.*
- *If inadmissible motions or forces are produced in the actuator as a result of the supply pressure level, it must be restricted by means of a suitable supply pressure reducing station.*
- *Proper shipping and appropriate storage are assumed.*

- ***Note!** The device with a CE marking fulfils the requirements of the Directives 94/9/EC (ATEX) and 89/336/EEC (EMC).*
  The declaration of conformity can be viewed and downloaded on the Internet at http://www.samson.de.

Positioner versions		**Type 3730 -0**	X
Explosion protection	Without		**0**
	Ex II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C acc. to ATEX		**1**
	Ex II 3 G EEx nA/nL IIC T6 / II 3 D IP 65 T 80 °C acc. to ATEX		**8**

1 Design and principle of operation

The electropneumatic positioner is mounted to pneumatic control valves and is used to assign the valve position (controlled variable x) to the control signal (reference variable w). The DC control signal received from a control unit is compared to the travel of the control valve and issues a signal pressure (output variable y).

The positioner is designed depending on the corresponding accessories for direct attachment to Type 3277 Actuators or for attachment to actuators according to IEC 60534-6 (NAMUR).

The positioner basically consists of a travel sensor system which is proportional to resistance, an analog i/p converter with downstream air capacity booster, and an analog controller electronics.

The position of the valve is transmitted as linear travel motion via pick-up lever and travel sensor (2) to an analog PD controller (3). The PD controller compares this actual position to the 4 to 20 mA DC control signal received from a control unit. In case of a system deviation, the operation of the i/p converter (6) is changed so that the actuator (1) is filled or vented via the downstream air capacity booster (7). This causes the valve plug to move to the position determined by the reference variable.

The pneumatic air capacity booster (7) and the pressure regulator (8) are provided with supply air. An intermediate flow regulator (9) with fixed settings is used to purge the positioner and also guarantees trouble-free operation of the pneumatic booster.

The output signal pressure supplied by the booster can be limited over the DIP switch **S5**.

The volume restriction Q (10) and the switch **S6** are used to optimize the positioner by adapting it to the actuator size and changing the gain factor.

Tight-closing function:
The pneumatic actuator is completely filled with air or vented as soon as the reference variable falls below or exceeds a preset value.

Fail-safe action "Actuator stem extends" (AIR TO OPEN):

Deactivation when switching point of 4.32 ± 0.16 mA is not reached:
The actuator is vented and a globe valve is closed tightly by the force of the actuator springs.
In the case of a three-way valve, port **B** is closed in mixing valves and port **A** is closed in diverting valves.

Fail-safe action "Actuator stem retracts" (AIR TO CLOSE)

Activation when switching point of 19.68 ± 0.16 mA is exceeded:
The actuator is filled with air and a globe valve is closed tightly by the signal pressure. In three-way valves, port **B** (mixing service) is closed and port **A** (diverting service) is closed.

1 Control valve
2 Travel sensor
3 PD controller
4 DIP switches
6 i/p converter
7 Air capacity booster
8 Pressure regulator
9 Flow regulator
10 Volume restriction

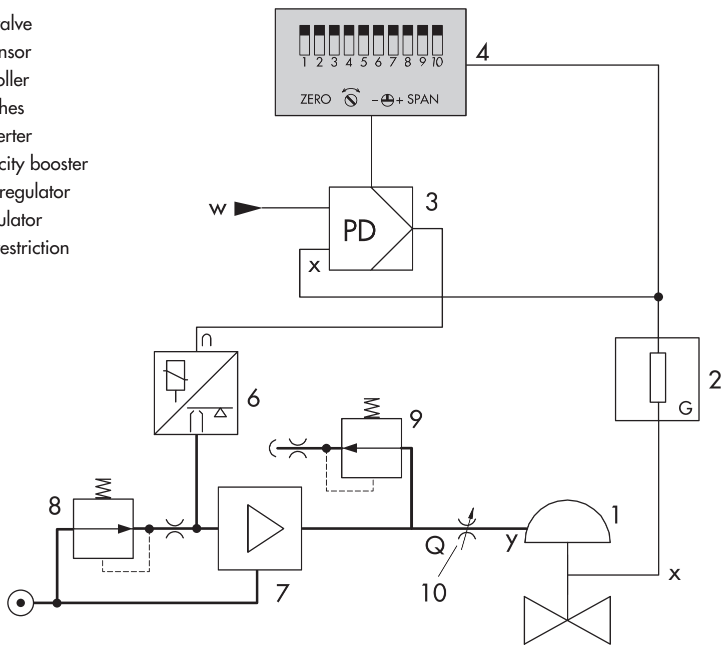


Fig. 2 · Functional diagram

1.1 Technical data

Positioner	
Nominal travel, adjustable	Direct attachment to Type 3277: 5.3 to 30 mm, Attachment acc. to IEC 60534-6: 5.3 to 200 mm
Travel range	Adjustable within the rated travel, max. ratio 1:5
Reference variable w	Signal range 4 to 20 mA, split-range range 4 to 12 mA/12 to 20 mA, selectable at DIP switches. 2-wire device, reverse polarity protection, static destruction limit 100 mA.
Minimum current	> 3.6 mA
Load impedance	Version without explosion protection: ≤6 V (corresponding to 300 Ω at 20 mA), explosion-protected version: ≤6 V
Supply air	Supply pressure from 1.4 to 6 bar (20 to 90 psi), Air quality acc. to ISO 8573-1: Max. particle size and density: Class 4 Oil content: Class 3, pressure dew point: Class 3 or at least 10 K below the lowest ambient temperature to be expected
Signal pressure (output)	0 bar up to supply pressure, can be limited to approx. 2.4 bar over DIP switch
Characteristic	Linear; Deviation from terminal-based conformity ≤1 %
Hysteresis	≤1 %
Sensitivity	≤0.1 %
Direction of action	Selectable over DIP switch
Air consumption, st. state	Independent of supply pressure approx. 120 l_n/h
Air delivery Actuator pressurized Actuator vented	 At Δp =6 bar: ≥ 8.5 m_n^3/h, at Δp = 1.4 bar: 3.0 m_n^3/h $K_{Vmax(20\ °C)}$ = 0.09 at Δp =6 bar: ≤14.0 m_n^3/h, at Δp = 1.4 bar: 4.5 m_n^3/h $K_{Vmax(20\ °C)}$ = 0.15
Permissible ambient temperature	–20 to +80 °C, with metal cable gland –40 to +80 °C The limits specified in the EC Type Examination Certificate additionally apply for explosion-protected devices.
Influences	Temperature: ≤0.15 %/10 K Supply air: None Vibration: ≤0.25 % up to 2000 Hz and 4 g acc. to IEC 770
Electromagnetic compatibility	Complying with requirements specified in EN 61000-6-2, EN 61000-6-3 and NAMUR Recommendation NE 21
Explosion protection	Ex II 2 G EEx ia IIC T6 / II 2 D IP 65 T 80 °C or Ex II 3 G EEx nA/nL IIC T6 / II 3 D IP 65 T 80 °C
Degree of protection	IP 65
Materials	Die-cast aluminum GD AlSi12 acc. to DIN 1725 (3.2582), chromated and plastic coated; External parts: Stainless steel 1.4571 and 1.4301
Weight	Approx. 1 kg

2 Attachment to the control valve – Mounting parts and accessories

The positioner can be attached either directly to a SAMSON Type 3277 Actuator or according to IEC 60534-6 (NAMUR) to control valves with cast yokes or rod-type yoke.

For attachment to the various actuators, corresponding mounting parts and accessories are required. These are listed with their order numbers in Tables 1 to 4.

On attaching the positioner, it is important to observe the assignment between lever and pin position according to the travels listed in the travel tables.

The travel that can be implemented at the valve is restricted by the pin position used and additionally by the selected fail-safe action and the actuator spring compression required.

The positioner is standard equipped with the lever **M** (pin position **35**).

Note!
If the standard mounted lever M (pin position 35) is replaced, the newly mounted lever must be moved once all the way as far as it will go in both directions to adapt it to the internal measuring lever.

Travel table for direct attachment to Type 3277 Actuator

	Actuator size cm^2	Rated travel mm	Adjustment range at positioner Travel Min.	Max.	Required lever	Assigned pin position
Type 3277-5 and 3277 Actuators	120	7.5	5.3	20	M	25
	120/240/350	15	5.3	35.4	M	35
	700	30	9.5	50	M	50

Travel table for attachment according to IEC 60534-6 (NAMUR)

SAMSON valves			Other valves/actuators		Required lever	Assigned pin position
	cm^2	Rated travel mm	Travel Min.	Max.		
Type 3271 Actuator	60 and 120 with Type 3510 Valve	7.5	5.3	17.6	S	17
	120	7.5	5.3	17.6	M	25
	120/240/350	15	7.5	35.4	M	35
	700/1400/2800	15 and 30/30	10	50	M	50
	1400/2800	60	14	70.8	L	70
	1400/2800	60	20	100	L	100
	2800	120	40	200	XL	200

Table 1	Direct attachment to Type 3277-5 Actuator		Order no.
Mounting parts	For actuators with 120 cm^2 effective diaphragm area, see Fig. 3		1400-7452
Accessories for the actuator	Switchover plate (old) for Actuator Type 3277-5xxxxxx.**00** (old)		1400-6819
	Switchover plate **new** for Actuator Type3277-5xxxxxx.**01** (new)		1400-6822
	Connecting plate for additional attachment of a solenoid valve G 1/8 Connecting plate (old) for Actuator Type 3277-5xxxxxx.**00** (old) 1/8 NPT		1400-6820 1400-6821
	Connecting plate **new** for Actuator Type 3277-5xxxxxx.**01** (new)		1400-6823
	***Note**: Only new switchover and connecting plates can be used with new actuators (Index 01). Old and new plates are not interchangeable.*		
Accessories for the positioner	Connecting plate (6)	G ¼: 1400-7461	¼ NPT: 1400-7462
	or pressure gauge bracket (7)	G ¼: 1400-7458	¼ NPT: 1400-7459
	Pressure gauge mounting kit (8) (output and supply)	Stainless steel/Brass: 1400-6950	Stainless steel/St. steel: 1400-6951
Table 2	Direct attachment to Type 3277 Actuator		
Accessories	Mounting parts for actuators with 240, 350 and 700 cm^2, see Fig. 4		1400-7453
	Required piping with screw fittings for "Actuator stem retracts" or when the top diaphragm chamber is filled with air	cm^2 Steel 240 1400-6444 350 1400-6446 700 1400-6448	Stainl. steel 1400-6445 1400-6447 1400-6449
	Connection block with seals and screw	G 1/4: 1400-8811	¼ NPT: 1400-8812
	Pressure gauge mounting kit (output and supply)	Stainless steel/Brass: 1400-6950	Stainl. steel/St. steel: 1400-6951

Table 3	Attachment to NAMUR ribs or control valves with rod-type yokes (rod diameter Ø 35 mm or smaller) according to IEC 60534-6, see Fig. 5		
Travel in mm	Lever	For actuators	Order no.
7.5	S	Type 3271-5 Actuator with 60/120 cm^2 on Type 3510 Valve, see Fig. 7	1400-7457
5 to 50	Without (lever M on basic model)	Actuators from other manufacturers and Type 3271 with 120 to 700 cm^2	1400-7454
14 to 100	L	Actuators from other manufacturers and Type 3271 with 1400 cm^2	1400-7455
40 to 200	XL	Actuators from other manufacturers and Type 3271 with 2800 cm^2, 120 mm travel	1400-7456
30 or 60	L	Type 3271 Actuator with 2800 cm^2 and 30 or 60 mm travel	1400-7466
Mounting brackets for Emerson and Masoneilan linear actuators In addition, a mounting kit acc. to IEC 60534-6 is required depending on the travel. See row above.			1400-6771
Accessories	Connecting plate	G ¼: 1400-7461 ¼ NPT: 1400-7462	
	or pressure gauge bracket (7)	G ¼: 1400-7458 ¼ NPT: 1400-7459	
	Pressure gauge mounting kit (output/supply)	St. steel/Brass: 1400-6950 St. steel/St. steel: 1400-6951	

Table 4	General accessories		
Accessories	Pneumatic reversing amplifier for double-acting actuators	G ¼ ¼ NPT	1079-1118 1079-1119
	Cable gland M20 x 1.5	Nickel-plated brass	1890-4875
	Adapter M 20 x 1.5 to ½ NPT, aluminum		0310-2149
	Cover plate with list of parameters and operating instructions	German/English (standard) English/Spanish English/French	1990-3528 1990-5769 1990-5768

2.1 Direct attachment

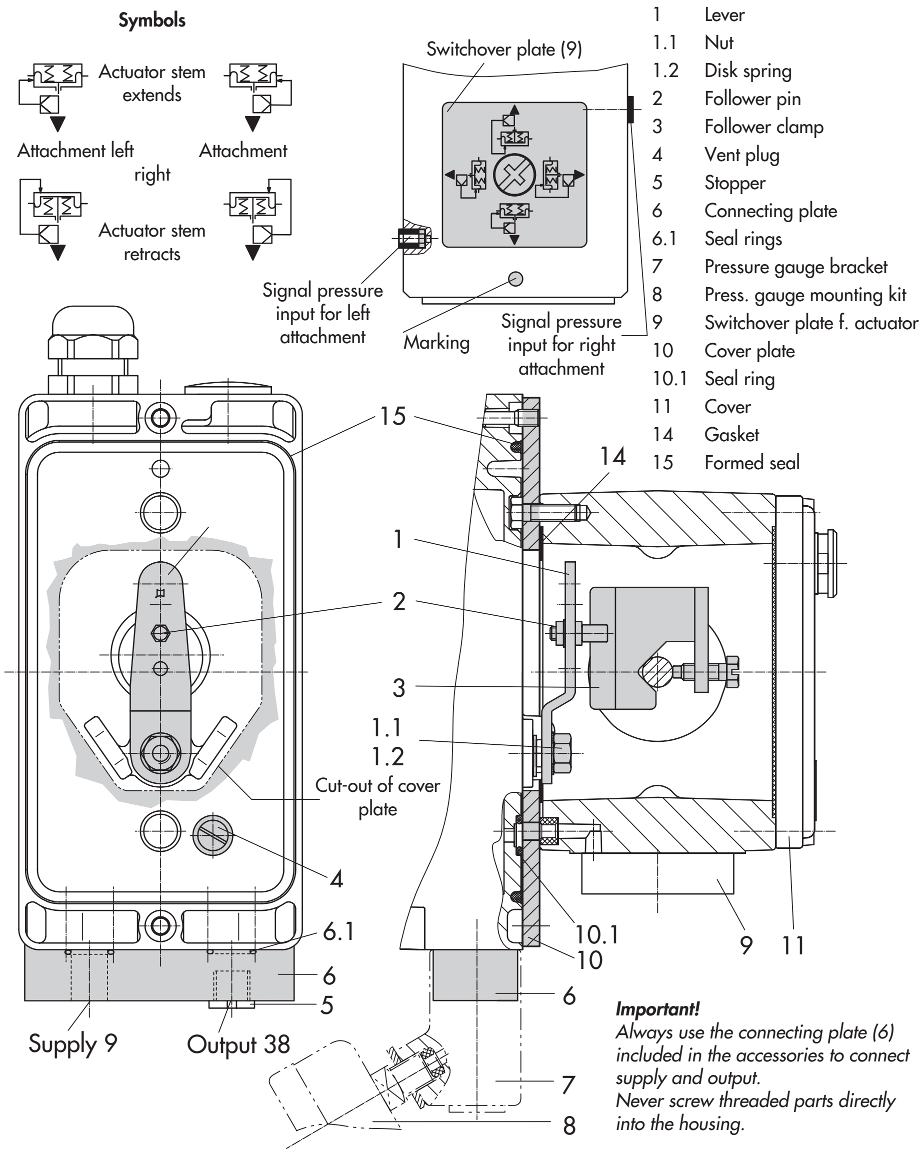
2.1.1 Type 3277-5 Actuator

Refer to Table 1 on page 8 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 7!

Actuator with 120 cm²

Depending on the type of positioner attachment, the signal pressure is routed either left or right of the yoke through a bore to the actuator diaphragm. Depending on the fail-safe action of the actuator "Actuator stem extends" or "Actuator stem retracts" (valve closes or opens if the supply air fails), the switchover plate (9) must first be attached to the actuator yoke. Align the switchover plate with the corresponding symbol for left or right attachment according to the marking (view looking onto the switchover plate).

1. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges onto the positioner, making sure both seal rings (6.1) are seated properly.
2. Remove vent plug (4) on the back of the positioner and close the signal pressure output "Output 38" on the connecting plate (6) or on the pressure gauge bracket (7) with the stopper (5) included in the accessories.
3. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
4. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 3, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
5. **15 mm travel:** Keep the follower pin (2) at lever **M** (1) on the back of the positioner in the pin position **35** (delivered state).
   7.5 mm travel: Remove the follower pin (2) from the pin position **35**, reposition it in the bore for pin position **25** and screw tight.
6. Insert formed seal (15) in the groove of the positioner casing.
7. Place positioner on the cover plate (10) in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch. The lever (1) must rest on the follower clamp with spring force.
   Mount the positioner on the cover plate (10) using the two fixing screws. During the installation make sure that the seal ring (10.1) is inserted in the bore of the intermediate plate.
8. Mount cover (11) on the other side.
   Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.



Important!
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

Fig. 3 · Direct attachment – Signal pressure connection for Type 3277-5 Actuator with 120 cm²

2.1.2 Type 3277 Actuator

Refer to Table 2 on page 8 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 7!

Actuators with 240 to 700 cm²

The positioner can be mounted either on the left or on the right side of the yoke. The signal pressure is routed to the actuator over the connection block (12), for actuators with fail-safe action "Actuator stem extends" internally through a bore in the valve yoke and for "Actuator stem retracts" through external piping.

1. Place follower clamp (3) on the actuator stem, align and screw tight so that the mounting screw is located in the groove of the actuator stem.
2. Mount cover plate (10) with narrow side of the cut-out opening (Fig. 4, on the left) pointing towards the signal pressure connection. Make sure that the bonded gasket (14) points towards the actuator yoke.
3. For actuators with 700 cm², remove the follower pin (2) at lever **M** (1) on the back of the positioner from pin position **35**, reposition it in the bore for pin position **50** and screw tight.
   For actuators 240 and 350 cm² with 15 mm travel, the follower pin (2) remains in pin position **35**.
4. Insert formed seal (15) in the groove of the positioner casing.
5. Place positioner on the cover plate in such a manner that the follower pin (2) rests on the top of the follower clamp (3). Adjust the lever (1) correspondingly and open the positioner cover to hold the positioner shaft in position at the cap or the switch. The lever (1) must rest on the follower clamp with spring force.
   Mount the positioner on the cover plate (10) using the two fixing screws.
6. Make sure that the tip of the gasket (16) projecting from the side of the connection block (12) is positioned above the actuator symbol that corresponds with the actuator with fail-safe action "Actuator stem extends" or "Actuator stem retracts." If necessary, remove the three fixing screws and the cover. Then reposition the gasket (16) turned by 180°.
   The previous version of the connection block (Fig. 4, bottom) requires the switch plate (13) to be turned such that the corresponding actuator symbol points to the marking.
7. Place the connection block (12) with the associated seal rings against the positioner and the actuator yoke. Screw it tight using the fixing screw (12.1). For actuators with fail-safe action "Actuator stem retracts", additionally remove the stopper (12.2) and fit on the external signal pressure piping.
8. Mount cover (11) on the other side.
   Make sure that the vent plug points downwards when the control valve is installed to allow any condensed water that collects to drain off.

- 1 Lever
- 1.1 Nut
- 1.2 Disk spring
- 2 Follower pin
- 3 Follower clamp
- 10 Cover plate
- 11 Cover
- 12 Connection block
- 12.1 Screw
- 12.2 Stopper or connection for external piping
- 13 Switch plate
- 14 Gasket
- 15 Formed seal
- 16 Gasket

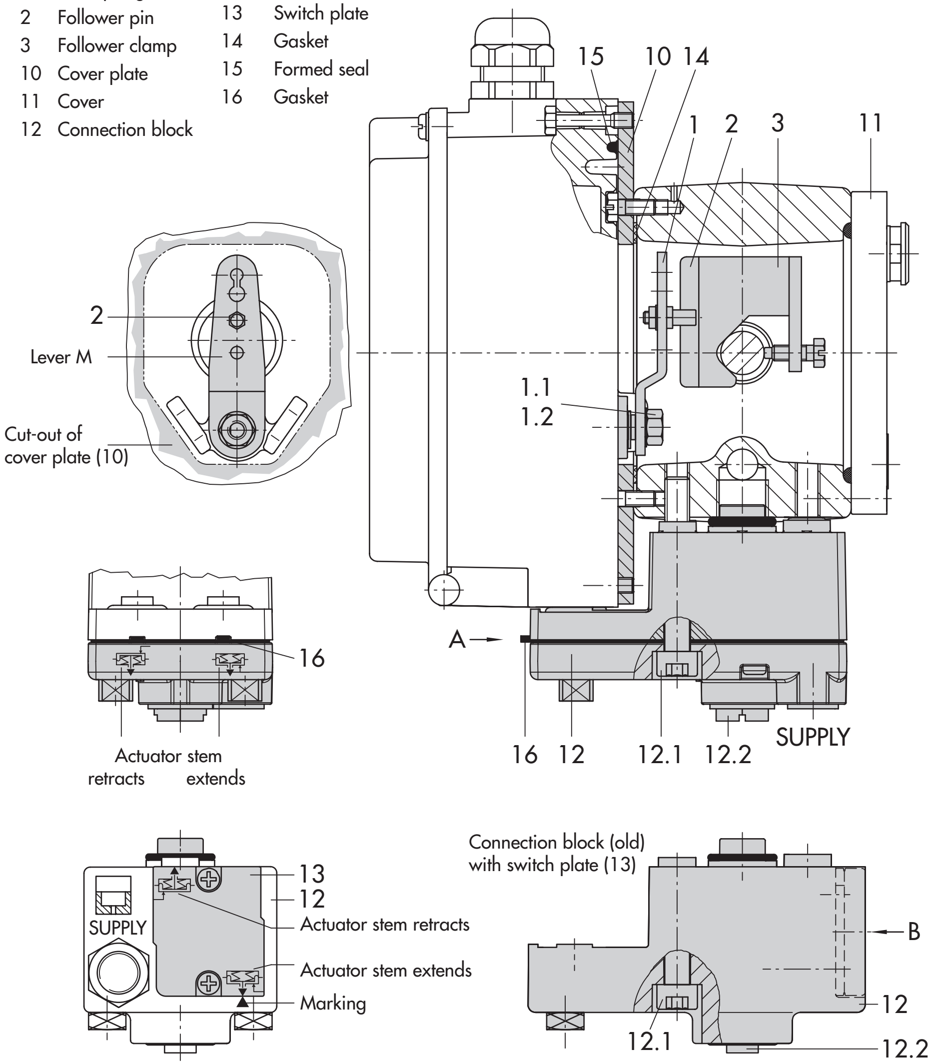


Fig. 4 · Direct attachment – Signal pressure connection for Type 3277 Actuator with 240, 350 and 700 cm^2

2.2 Attachment according to IEC 60534-6

The positioner is attached to the control valve with a NAMUR bracket (10).

Refer to Table 3 on page 9 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 7!

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1. Screw the two bolts (14) to the bracket (9.1) of the stem connector (9), place the follower plate (3) on top and use the screws (14.1) to tighten.

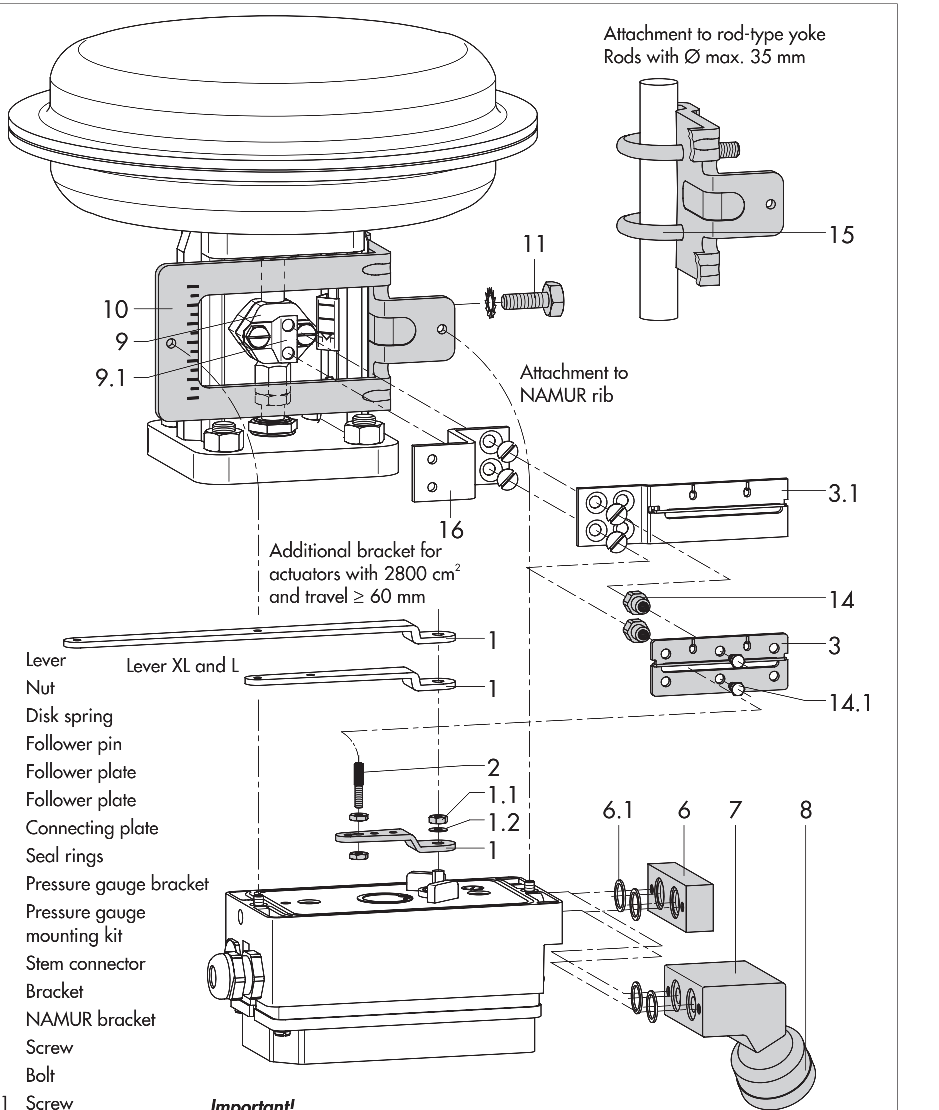
Actuator size 2800 cm^2:
For a travel of 60 mm or smaller, screw the longer follower plate (3.1) directly to the stem connector (9). For a travel exceeding 60 mm, mount the bracket (16) first and then the follower plate (3) to the bracket together with the bolts (14) and screws (14.1).

2. Mount NAMUR bracket (10) to the control valve as follows:
   For attachment to the NAMUR rib, use an M8 screw (11) and toothed lock washer directly in the yoke bore.
   For attachment to valves with rod-type yokes, use two U-bolts (15) around the yoke.
   Align the NAMUR bracket (10) according to the embossed scale so that the slot of the follower plate (3) is centrally aligned with the NAMUR bracket at mid valve travel.
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges (8) on the positioner, making sure both seal rings (6.1) are seated properly.
4. Select required lever size (1) **M**, **L** or **XL** and pin position according to the actuator size and valve travels listed at the bottom of the table.
   Should you require a pin position other than position **35** with the standard installed lever **M**, or require a lever size **L** or **XL**, proceed as follows:
5. Screw the follower pin (2) in the assigned lever bore (pin position) as listed in the table. Only use the longer follower pin (2) included in the mounting kit.
6. Place lever (1) on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).

Note!
If you have mounted a new lever (1), you must move it once all the way as far as it will go in both directions.

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7. Place positioner on the NAMUR bracket in such a manner that the follower pin (2) rests in the slot of the follower plate (3, 3.1). Adjust the lever (1) correspondingly.
   Screw the positioner to the NAMUR bracket using both its fixing screws.



1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Follower plate
3.1	Follower plate
6	Connecting plate
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
9	Stem connector
9.1	Bracket
10	NAMUR bracket
11	Screw
14	Bolt
14.1	Screw
15	U-bolt
16	Bracket

Important!
Always use the connecting plate (6) included in the accessories to connect supply and output. Never screw threaded parts directly into

Fig. 5 · Attachment according to IEC 60534-6 (NAMUR)

2.3 Reversing amplifier for double-acting actuators

For the use with double-acting actuators, the positioner must be fitted with a reversing amplifier. The reversing amplifier is listed as an accessory in the Table 4 on page 9.

The output signal pressure of the positioner is supplied at the output $\mathbf{A_1}$ of the reversing amplifier. An opposing pressure, which equals the required supply pressure when added to the pressure at $\mathbf{A_1}$, is applied at output $\mathbf{A_2}$.
The rule $\mathbf{A_1} + \mathbf{A_2} = \mathbf{Z}$ applies.

Mounting

1. Mount the connecting plate (6) from the accessories in Table 4 to the positioner. Make sure that both O-rings (6.1) are seated correctly.
2. Thread the special nuts (1.3) from the accessories of the reversing amplifier into the boreholes of the connecting plate.
3. Insert the gasket (1.2) into the recess of the reversing amplifier and push both the special hollow screws (1.1) into the connecting boreholes $\mathbf{A_1}$ and **Z**.
4. Place the reversing amplifier onto the connecting plate (6) and screw tight using both the special screws (1.1).
5. Use a screwdriver (8 mm wide) to screw the enclosed filters (1.6) into the connecting boreholes $\mathbf{A_1}$ and **Z**.

Note!
The sealing plug (1.5) should not be unscrewed out of the reversing amplifier.
The rubber seal (1.4) is not required and can be removed when the sealing plug is used.

Signal pressure connections

$\mathbf{A_1}$: Output $\mathbf{A_1}$ leading to the signal pressure connection at the actuator which opens the valve when the pressure increases

$\mathbf{A_2}$: Output $\mathbf{A_2}$ leading to the signal pressure connection at the actuator which closes the valve when the pressure increases

- Position the DIP switch **S1** according to the symbols AIR TO OPEN or AIR TO CLOSE as described in section 5.2.

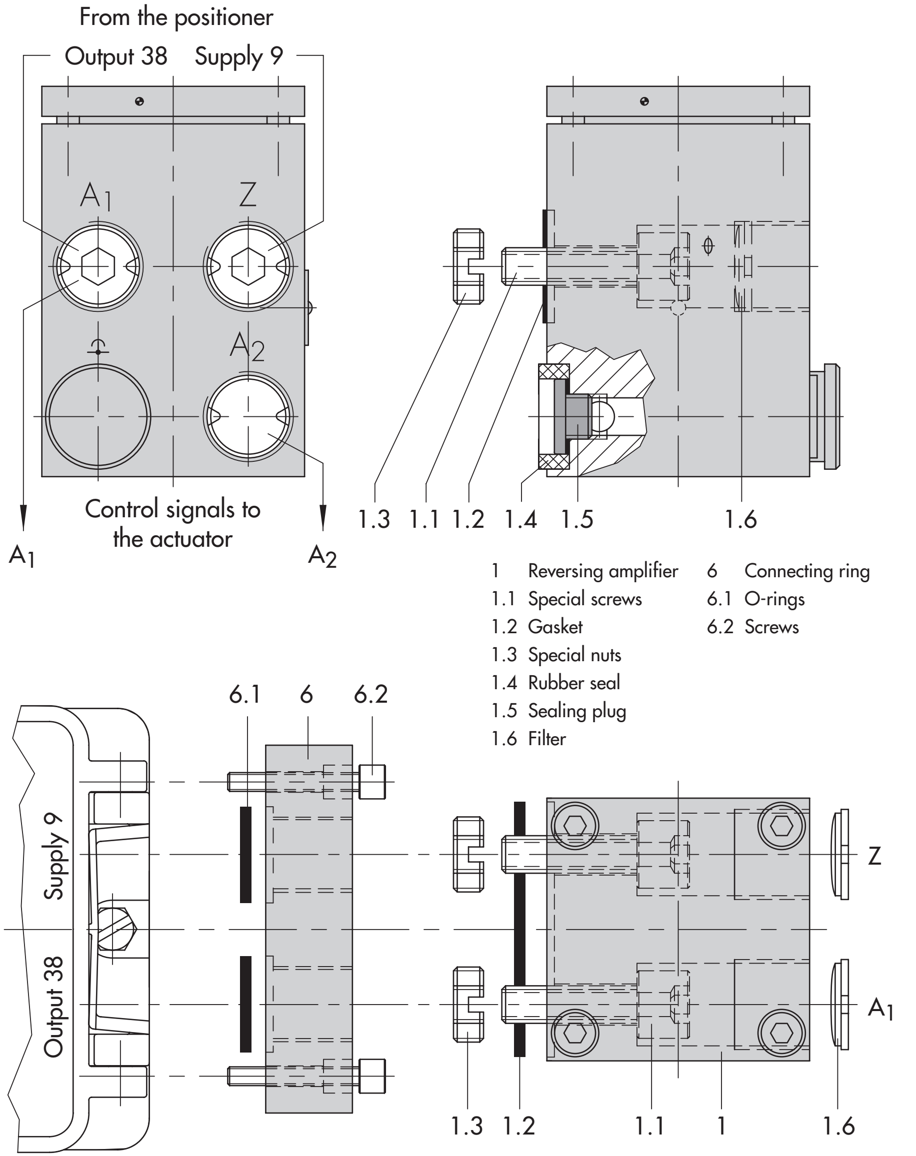


Fig. 6 · Mounting a reversing amplifier

2.4 Attachment to Type 3510 Micro-flow Valve

The positioner is attached to the valve yoke using a bracket.

Refer to Table 3 on page 9 for the required mounting parts as well as the accessories with their order numbers.
Note the travel table on page 7!

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1. Place clamp (3) on the valve stem connector, align at a right angle and screw tight.
2. Screw bracket (10) to the valve yoke using two screws (11).
3. Mount connecting plate (6) or pressure gauge bracket (7) with pressure gauges to the positioner, making sure both seal rings (6.1) are seated properly.
4. Unscrew the standard installed lever **M** (1) including follower pin (2) from the positioner shaft.
5. Take lever **S** (1) and screw follower pin (2) in the bore for pin position **17**.
6. Place lever **S** on the positioner shaft and screw tight using the disk spring (1.2) and nut (1.1).
   Move lever once all the way as far as it will go in both directions.
7. Place positioner on the bracket (10) in such a manner that the follower pin slides into the groove of the clamp (3).
   Adjust the lever (1) correspondingly.
   Screw the positioner to the bracket (10) using both its hexagon screws.

1	Lever
1.1	Nut
1.2	Disk spring
2	Follower pin
3	Clamp
6	Connecting plate
6.1	Seal rings
7	Pressure gauge bracket
8	Pressure gauge mounting kit
10	Bracket

Important!
Always use the connecting plate (6) included in the accessories to connect supply and output.
Never screw threaded parts directly into the housing.

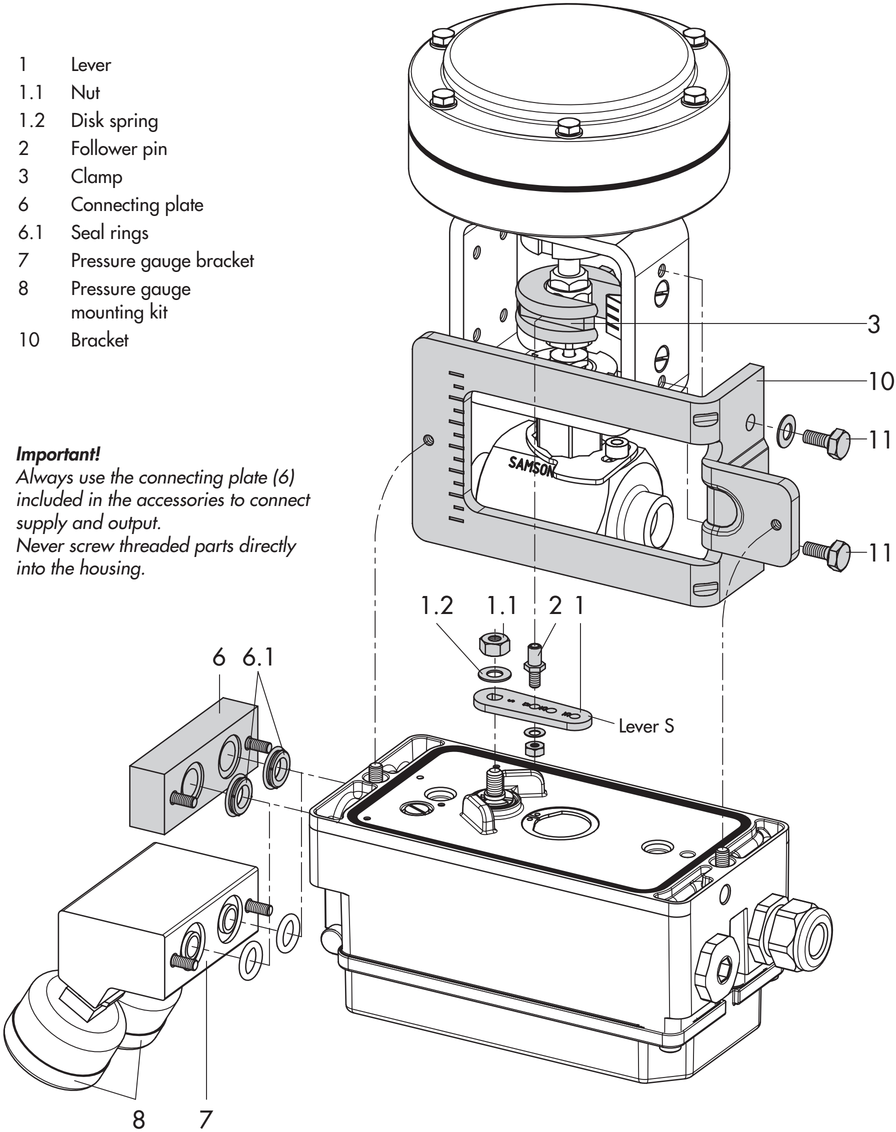


Fig. 7 · Attachment to Type 3510 Micro-flow Valve

3 Connections

3.1 Pneumatic connections

Caution!
The threads in the positioner housing are not designed for direct air connection!

The screw glands must be screwed into the connecting plate, the pressure gauge mounting block or the connection block from the accessories. The air connections are optionally designed as a bore with ¼ NPT or G ¼ thread.
The customary fittings for metal and copper pipes or plastic hoses can be used.

Note!
The supply air must be dry and free from oil and dust. The maintenance instructions for upstream pressure reducing stations must be observed.
Blow through all air tubes and hoses thoroughly prior to connecting them.

If the positioner is attached directly to the Type 3277 Actuator, the connection of the positioner's output pressure to the actuator is fixed. For attachment according to IEC 60534-6 (NAMUR), the signal pressure can be routed to either the top or bottom diaphragm chamber of the actuator, depending on the actuator's fail-safe action "Actuator stem extends" or "Actuator stem retracts".

3.1.1 Signal pressure gauges

To monitor the supply air (Supply) and signal pressure (Output), we recommend that pressure gauges be attached (see accessories in Tables 1 to 4).

3.1.2 Supply pressure

The required supply air pressure depends on the bench range and the actuator's operating direction (fail-safe action). The bench range is registered on the nameplate either as spring range or signal pressure range.
The direction of action is marked **FA** or **FE**, or by a symbol.

Actuator stem extends FA (Air to open ATO)

Fail-safe position "Valve Closed"
(for globe and angle valves):

Required supply pressure = Upper bench range value + 0.2 bar, minimum 1.4 bar.

Actuator stem retracts FE (Air to close ATC)

Fail-safe position "Valve Open"
(for globe and angle valves):
For tight-closing valves, the maximum signal pressure pst_{max} is roughly estimated as follows:

$$pst_{max} = F + \frac{d^2 \cdot \pi \cdot \Delta p}{4 \cdot A}$$

d = Seat diameter [cm]
Δp = Differential pressure across the valve [bar]
A = Actuator diaphragm area [cm^2]
F = Upper bench range of the actuator [bar]

If there are no specifications, calculate as follows:

Required supply pressure =
Upper bench range value + 1 bar

Note!
*The signal pressure at the output (Output 38) of the positioner can be limited to approx. 2.4 bar by setting the DIP switch **S5**.*

3.2 Electrical connections

For electrical installation, you are required to observe the relevant electrotechnical regulations and the accident prevention regulations that apply in the country of use. In Germany, these are the VDE regulations and the accident prevention regulations of the employers' liability insurance association.
The following standards apply for assembly and installation in hazardous areas: EN 60079-14: 2003 (VDE 0165 Part 1/ 8.98) "Electrical apparatus for explosive gas atmospheres" and EN 50281-1-2: 1999 (VDE 0165 Part 2/11.99) "Electrical apparatus for use in the presence of combustible dust".

For the interconnection of intrinsically safe electrical equipment, the permissible maximum values specified in the EC type examination certificate apply (U_i or U_0; I_i or I_0; P_i or P_0; C_i or C_0, and L_i or L_0).

The following applies for equipment with type of protection EEx nA (non-sparking apparatus) according to the standard EN 50021 (1999): Connecting, interrupting, or switching circuits while energized is only allowed during installation, maintenance or repair work.

The following applies for equipment connected to energy-limited circuits with type of protection EEx nL (energy-limited apparatus) according to the standard EN 50021 (1999): This type of equipment may be switched under normal operating conditions.

For the interconnection of equipment to energy-limited circuits with type of protection EEx nL IIC, the permissible maximum values specified in the statement of conformity or the addenda to the statement of conformity apply.

Caution!
The terminal assignment specified in the certificate must be adhered to.
Reversing the assignment of the electrical terminals may cause the explosion protection to become ineffective.
Do not tamper with enameled screws inside or on the housing.
Cable entries left unused must be sealed with blanking plugs.
Devices used at ambient temperatures below –20 °C must have metal cable entries.

The wires for the reference variable must be connected to the terminals 11 and 12 located in the housing.

In general, it is not necessary to connect the positioner to a bonding conductor. Should this be required, however, this conductor can be connected inside the device.

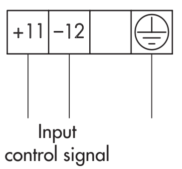


Fig. 8 · Electrical connection

Note!
The minimum permissible reference variable should not fall below 3.6 mA.

Accessories:

Plastic cable gland M20 x 1.5:

Black	Order no. 1400-6985
Blue	Order no. 1400-6986
Nickel-plated brass	Order no. 1890-4875

Adapter M20 x 1.5 to ½ NPT
Aluminum, powder-coated
Order no. 0310-2149

4 Operation

4.1 Operator controls

DIP switches S1 to S10

The positioner is mainly operated via the DIP switches, which allow you to set the most important functions.

ZERO and SPAN adjusters

The ZERO and SPAN potentiometers are used to adjust the starting point (zero) and the upper range value (span) of the reference variable.

Volume restriction Q

The volume restriction is used to adapt the air supply to the actuator size. Depending on the air passage at the actuator, two fixed settings are available.

DIP switches and their functions		S5	Limit output signal pressure to 2.4 bar
S1	Fail-safe action of the actuator	S6	Change gain factor
S2/S3	Rated travel of the control valve	S7/S8	Set range of reference variable
S4	Direction of action w/x	S9/S10	Activate tight-closing function

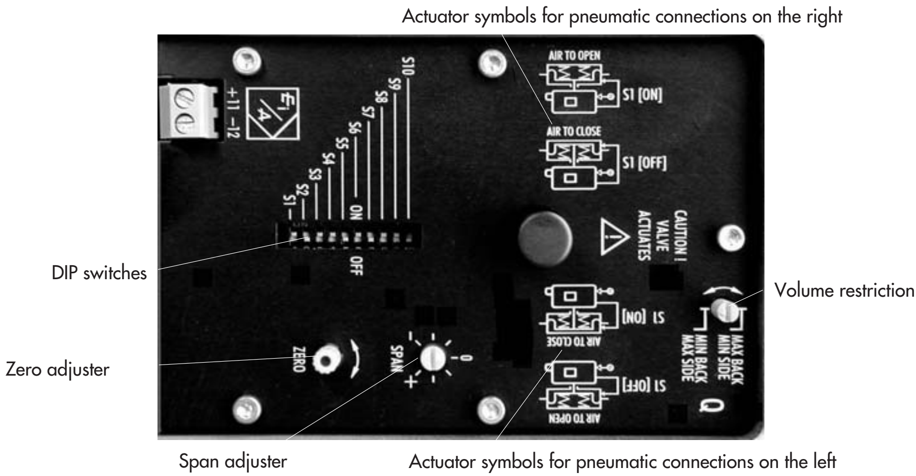


Fig. 9 · Operator controls

5 Start-up and settings

5.1 Default switch positions

After the positioner has been mounted on the valve, all switches **S1 to S10** must be set to **OFF**.

5.2 Fail-safe position

At switch **S1**, the fail-safe action of the actuator "Actuator stem extends" (AIR TO OPEN - signal pressure opens the valve) or "Actuator stem retracts" (AIR TO CLOSE - signal pressure closes the valve) must be adjusted.

To do so, read the associated switch position **S1 = ON** or **OFF** from the cover plate.

The symbols that can be read properly when the valve is mounted with the actuator upright on top apply; the ones written upside down are not valid.

- For valves with actuator version "Actuator stem extends" (AIR TO OPEN), actuator on top, pneumatic connections point to
  right **S1 = ON**, left **S1 = OFF**

- For valves with actuator version "Actuator stem retracts" (AIR TO CLOSE), actuator on top, pneumatic connections point to
  right **S1 = OFF,** left **S1 = ON**

5.3 Volume restriction Q

- For actuators smaller than 240 cm^2 with a loading pressure connection at the side (Type 3271-5), set restriction to MIN SIDE.
- For a connection at the back (Type 3277-5), set restriction to MIN BACK.
- For actuators 240 cm^2 and larger, set to MAX SIDE for a side connection and to MAX BACK for a connection at the back.

5.4 Presetting the travel

At switches **S2** and **S3**, the travel which comes closest to the rated valve travel is to be adjusted, taking into account the pin position. If necessary, the final adjustment is to be made as described in section 5.12.

Pin position	Travel when span adjuster is at 0			
	S2 OFF S3 OFF	S2 ON S3 OFF	S2 OFF S3 ON	S2 ON S3 ON
17		5.3	7.5	10.6
25	5.3	7.5	10.6	15
35	7.5	10.6	15	21.2
50	10.6	15	21.2	30
70	15	21.2	30	42.4
100	21.2	30	42.4	60
200	42.4	60	84.8	120

5.5 Direction of action

At switch **S4**, the direction of action w/x is to be adjusted.

> > The valve travel x increases when the reference variable w increases, or the valve travel decreases when the reference variable decreases.

< > The valve travel decreases when the reference variable increases, or the valve travel increases when the reference variable decreases.

Fail-safe action AIR TO OPEN – Actuator stem extends	>>	S4	ON
	<>		OFF
Fail-safe action AIR TO CLOSE – Actuator stem retracts	>>	S4	OFF
	<>		ON

5.6 Connecting the positioner

Apply the supply air to the pneumatic connection (Supply 9). Make sure to use the appropriate pressure as specified in section 3.1.2.

Apply the electric reference variable (ammeter at terminals 11 and 12).

⚠ ***Caution!***
Upon connection of the electric reference variable, the signal pressure may cause the plug stem to move, risk of injury!

5.7 Limiting the output signal pressure

Set switch **S5 to ON** to limit the output signal pressure to 2.4 bar if required by the actuator.

5.8 Presetting zero

- Set **SPAN** adjuster to 0.

For fail-safe action "Actuator stem extends" (AIR TO OPEN):

- Adjust the input signal to 4 mA using an ammeter.
- Turn ZERO adjuster until the plug stem just starts to move from its initial position.

For fail-safe action "Actuator stem retracts" (AIR TO CLOSE):

- Adjust the input signal to 20 mA using an ammeter.
- Turn ZERO adjuster until the plug stem just starts to move from its initial position.

5.9 Gain factor

When the control response is unstable, set switch **S6** to **ON** to reduce the gain of the control loop. It is recommended to check zero when this switch position has been changed.

5.10 Reference variable

Use switches **S7** and **S8** to adjust the input signal, i.e. the range of the reference variable.

Switches	S7 OFF	S8 OFF	S7 ON	S8 OFF	S7 OFF	S8 ON
Input mA	4...11.9		12.1...20		4...20	

In split-range operation (Fig. 10, right), the control valves work with smaller reference variable ranges. The signal to control two control valves is divided such that both valves move through their full travel range at 50 % of the input signal (e.g. first valve set to 4 to 11.9 mA and second valve adjusted to 12.1 to 20 mA).

To avoid overlapping, a dead band of ±0.1 mA is to be observed.

5.11 Adjusting zero

Upon adjustment at the control valve, the travel must be adapted to the reference variable. For example, with a reference variable of 4 to 20 mA, the valve must also move through its full travel range from 0 to 100 % (Fig. 10, left).

The starting point (zero) always refers to the closed position of the control valve. Depending on the fail-safe position of the valve "Actuator stem extends" (AIR TO OPEN) or "Actuator stem retracts" (AIR TO CLOSE) and the direction of action of the positioner (>> or <>), zero can either be the lower or upper range value (4, 12 or 20 mA) of the reference variable range.

For "Actuator stem extends" (AIR TO OPEN):
Starting point (e.g. 4 mA)

- Adjust the input signal to 4 mA using an ammeter.
- Turn **ZERO** adjuster until the plug stem just starts to move from its closed position.

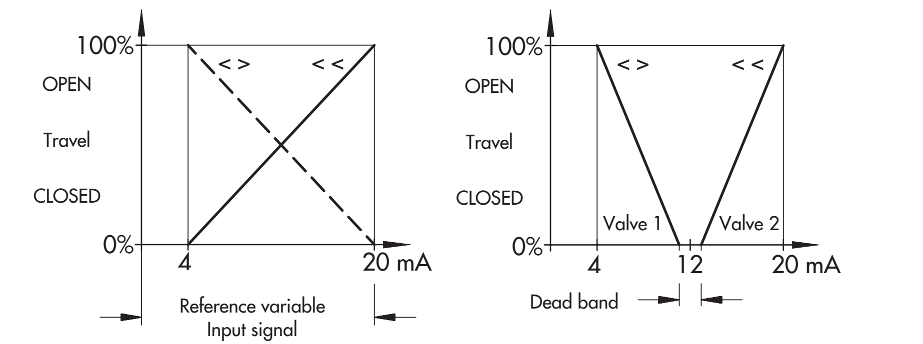


Fig. 10 · Standard and split-range operation

- Interrupt input signal and slowly reapply it. Check whether the plug stem starts to move at 4.0 mA.

- Correct deviation at the **ZERO** adjuster.

For "Actuator stem retracts" (AIR TO CLOSE):
Starting point (e.g. 20 mA)

- Adjust the input signal to 20 mA using an ammeter.
- Turn **ZERO** adjuster until the plug stem just starts to move from its closed position.
- Increase the input signal and slowly decrease it back to 20 mA.
  Check whether the plug stem starts to move at 20.0 mA.
- Correct deviation at the **ZERO** adjuster.

5.12 Adapting the travel

In case the rated travel of the control valve does not correspond with the selected travel according to the table in section 5.4:

- Adjust the upper range value of the input signal (e.g. 4, 12 or 20 mA) using the ammeter.
- Turn the SPAN adjuster until the plug stem comes to a stop in its end position.

5.13 Activate the tight-closing function

Having adjusted zero and span, the tight-closing function (description on page 4) must be activated at switches **S9** and **S10** to ensure a tight valve shut-off.

AIR TO OPEN Actuator stem extends	S9 ON	S10 OFF
AIR TO CLOSE Actuator stem retracts	S9 OFF	S10 ON
Three-way valve	S9 ON	S10 ON

6 Maintenance

The positioner does not require any maintenance.

There are filters with a 100 µm mesh size in the pneumatic connections for supply and output which can be removed and cleaned, if required.

The maintenance instructions of any upstream supply air pressure reducing stations must be observed.

7 Servicing explosion-protected devices

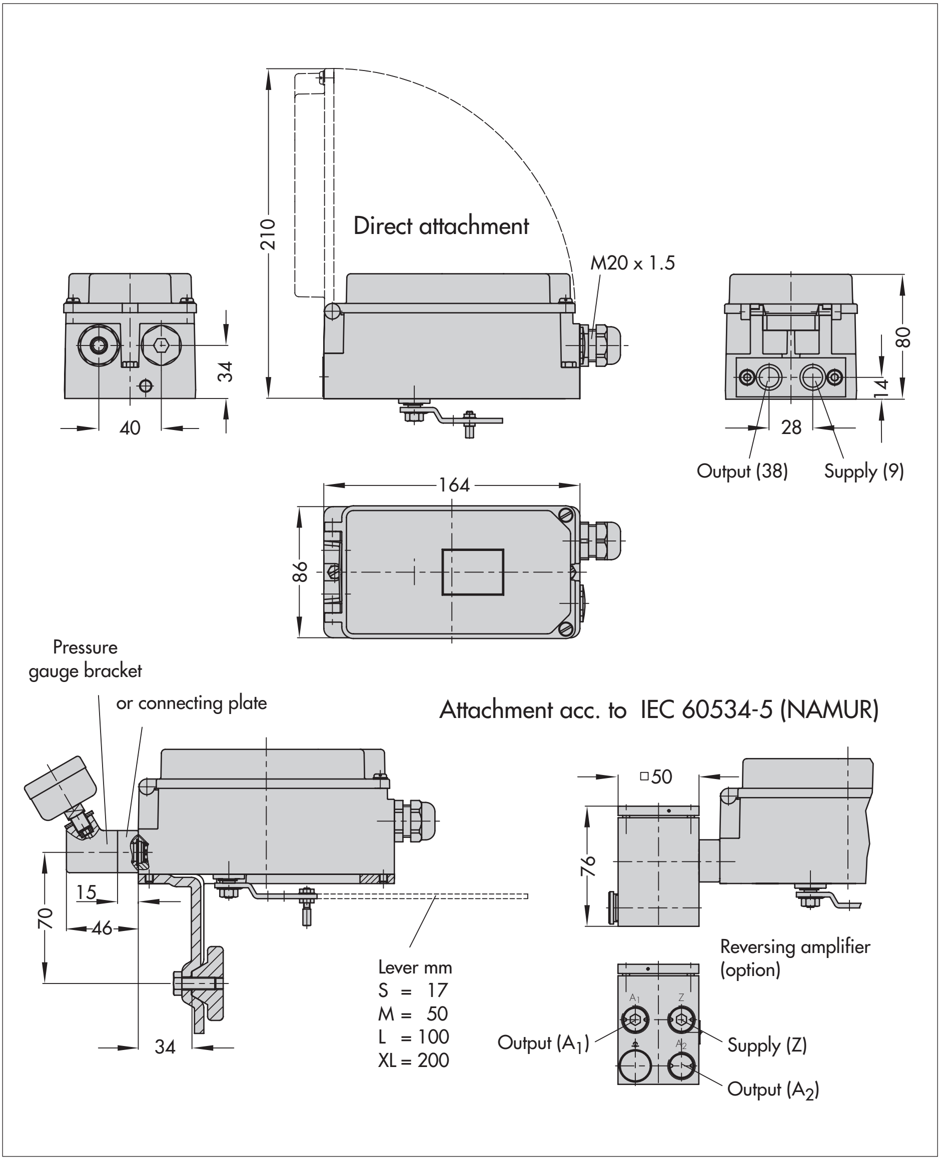
If a part of the positioner on which the explosion protection is based needs to be serviced, the positioner must not be put back into operation until an expert has inspected the device according to explosion protection requirements, has issued a certificate stating this or given the device a mark of conformity.

Inspection by an expert is not required if the manufacturer performs a routine check on the device prior to putting it back into operation. The passing of the routine check must be documented by attaching a mark of conformity to the device.

Explosion-protected components may only be replaced by original, checked components from the manufacturer.

Devices that have already been used outside of hazardous areas and are intended for use in hazardous areas in future must comply with the safety demands placed on repaired devices. Prior to operation, they must be tested according to the specifications stipulated for "Repairing explosion-protected devices".

8 Dimensions in mm



Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

TRANSLATION

(1) **EC TYPE EXAMINATION CERTIFICATION**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 03 ATEX 2099

(4) Equipment: Model 3730-01 . . . Positioner

(5) Manufacturer: SAMSON AG Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, 60314 Frankfurt, Germany

(7) This equipment and any acceptable variation thereof are specified in the schedule to this certificate.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 in according to Article 9 of the Council Directive 94/9/EC of 23 March 1994, certifies that this equipment has been found to comply with the Essential Health and Safety Requirement relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres given in Annex II to the Directive.

The examination and test results are recorded in confidential report PTB Ex 03-23199

(9) The essential health and safety requirements are satisfied by compliance with

EN 50014: 1997+A1+A2 **EN 50020: 2002**

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use specified in the schedule to this certificate.

(11) This EC Type Examination Certificate relates only to the design and examination of the specified equipment in compliance with Directive 94/9/EC. Further requirements of this Directive apply to the manufacture and supply of the equipment. These requirements are not covered by this Certificate.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

(12) The marking of the equipment shall include the following:

II 2 G EEx ia IIC T6

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 21 July 2003

(Signature) (Seal)

Dr. Ing. U. Gerlach
Regierungsdirketor

EC Type Examination Certificates without signature and seal are invalid.
This EC Type Examination Certificate may only be reproduced in its entirety and without any changes, schedule included.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt., Bundesallee 100, D-38116 Braunschweig

(13) **S c h e d u l e**

(14) **EC TYPE EXAMINATION CERTIFICATE No. PTB 03 ATEX 2099**

(15) **Description of Equipment**

The Model 3730-01 . . Positioner is a single- or double-acting positioner for attachment, to linear or rotary actuators. It serves for translating control signals into valve stem positions.

The Model 3730-01 . . Positioner is a passive two-terminal network which may be connected to any certified intrinsically safe circuit, provided the permissible maximum values of Ui, Ii and Pi are not exceeded.

For air supply non-combustible media are used.

The device is intended for use inside and outside of hazardous loctions.

The correlation between temperature classification and permissible temperature ranges is shown in the table below.

Temperature class	Permissible ambient temperature range
T6	-40°C . . .50°C
T5	-40°C . . .70°C
T4	-40°C . . .80°C

Electrical data

Signal circuit (terminals 11/12) — Type of protection: Intrinsic safe EEx ia IIC only for connction to a certified intrinsically safe circuit

Maximum values:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5,3 nF; L_i negligible

(16) **Test Report PTB Ex 03-23199**

Schedule to the EC Type Examination Certificate No. PTB 03 ATEX 2099

(17) **Special conditions for safe use**

None

(18) **Special health and safety requirements**

In compliance with the standards specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 21 July 2003

(Signature) (seal)

Dr. Ing. U. Gerlach
Regierungsdirektor

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

TRANSLATION

(1) **Statement of Conformity**

(2) Equipment and Protective Systems Intended for Use in Potentially Explosive Atmospheres – **Directive 94/9/EC**

(3) EC Type Examination Certificate Number

PTB 03 ATEX 2179 X

(4) Equipment: Model 3730-08.. e/p Positioner

(5) Manufacturer: SAMSON AG Mess- und Regeltechnik

(6) Address: Weismüllerstr. 3, 60314 Frankfurt am Main, Germany

(7) The equipment and any acceptable variation thereof are specified in the schedule to this certificate and the documents referred to therein.

(8) The Physikalisch-Technische Bundesanstalt, notified body number 0102 according to Article 9 of the Council Directive 94/9/ of 23 March 1994, certifies that this equipment has been found to comply with the essential health and safety requirements relating to the design and construction of equipment and protective systems intended for use in potentially explosive atmospheres specified in Annex II to the Directive.

The examination and test results are recorded in confidential report.

PTB Ex 03-23300

(9) The essential health and safety requirements are satisfied by compliance with

EN 50021: 1999

(10) If the sign "X" is placed after the certificate number, it indicates that the equipment is subject to special conditions for safe use as specified in the schedule to this certificate.

(11) In compliance with the Directive 94/9/EC this Statement of Conformity relates only to the dessign and consturciton of the equipment specified. Further requirements of this Directive apply to manufacture and marketing of this equipment.

Physikalisch-Technische Bundesanstalt
Braunschweig und Berlin

PTB

(12) The marking of the equipment shall include the following:

II 3 G EEx nA IIC T6

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 30. September 2003

(Signature) (Seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirketor

Statements of Conformity without signature and seal are invalid.
This Statement of Conformity may be reproduced only in its entirety without any changes.
Extracts or changes shall require the prior approval of the Physikalisch-Technische Bundesanstalt.

Physikalisch-Technische Bundesanstalt Bundesallee 100 D-38116 Braunschweig **Ptb37 Ex n.doc**

(13) **S c h e d u l e**

(14) **Statement of Conformity PTB 03 ATEX 2179 X**

(15) **Description of Equipment**

The Model 3730-08.. e/p Positioner is a single- or double-acting positioner for attachment to linear or rotary actuators. It serves for translating control signals into valve stem positioners.

For pneumatic auxiliary power non-combustible media are used.

The device is intended for use inside and outside of hazardous locations.

The correlation between temperature classification and permissible ambient temperature ranges is shown in the table below:

Temperature class	Permissible ambient temperature range
T6	-40 °C ...50 °C
T5	-40 °C ...70 °C
T4	-40 °C ... 80 °C

Electrical data

Signal circuit (terminals 11/12) — Type of protection EEx nA II

(16) Test report **PTB Ex 03-23300**

(17) The signal circuit (terminals 11/12) shall be preceded by a fuse installed outside of the hazardous location. This fuse shall comply with IEC 60127-2/II, 250 V F, or with IEC 50127-2/VI, 250 V T with a maximum fuse nominal current IN ≤ 80 mA.

The cable entries of the enclosure for the Model 3730.08.. e/p Positioner shall provide at least Degree of Protection IP 54 in compliance with EN 60529. The wiring shall be connected in such a manner that the connection facilities are not subjected to pull and twisting.

(18) **Basis health and safety requirements**

Are satisfied by compliance with the standard specified above.

Zertifizierungsstelle Explosionsschutz
By order

Braunschweig, 30. September 2003

(Signature) (seal)

Dr. Ing. U. Johannsmeyer
Regierungsdirektor

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. E R G Ä N Z U N G

zur Konformitätsaussage PTB 03 ATEX 2179 X

Gerät: e/p-Stellungsregler Typ 3730-08..

Kennzeichnung: Ⓔx **II 3 G EEx nA II T6**

Hersteller: SAMSON AG Mess- und Regeltechnik

Anschrift: Weismüllerstraße 3, 60314 Frankfurt am Main, Deutschland

<u>Beschreibung der Ergänzungen und Änderungen</u>

Der e/p-Stellungsregler Typ 3730-08.. darf künftig auch an energiebegrenzte Stromkreise der Zündschutzart EEx nL IIC T6 angeschlossen werden. Die elektrischen Daten werden ergänzt:

<u>Elektrische Daten</u>

Signalstromkreis .... in Zündschutzart EEx nA II
(Klemmen 11/12)

bzw.

in Zündschutzart EEx nL IIC
Betriebliche Höchstwerte:

U_i = 28 V
I_i = 115 mA
P_i = 1 W

C_i = 5,3 nF
L_i vernachlässigbar klein

bzw.

U_i = 30 V
I_i = 100 mA
P_i = 1 W

C_i = 5,3 nF
L_i vernachlässigbar klein

Physikalisch-Technische Bundesanstalt

Braunschweig und Berlin

1. Ergänzung zur Konformitätsaussage PTB 03 ATEX 2179 X

Das Gerät ist in einem Metallgehäuse montiert, welches mindestens den Schutzgrad IP54 gewährleistet.

Die Kennzeichnung des e/p-Stellungsreglers Typ 3730-08.. wird ergänzt:

Ⓔx **II 3 G EEx nA II T6 bzw. II 3 G EEx nL IIC T6**
II 3 D IP 54 T 80 °C bzw. II 3 D IP 65 T 80 °C

Die besonderen Bedingungen werden ergänzt:

Wenn der Signalstromkreis des e/p-Stellungsreglers Typ 3730-18.. an einen Stromkreis der Zündschutzart EEx nA II angeschlossen wird, ist dem Signalstromkreis eine Sicherung nach IEC 60127-2/II, 250 V F bzw. nach IEC 60127-2/VI, 250 V T mit einem Sicherungsnennstrom von maximal $I_N \le 80$ mA vorzuschalten. Die Sicherung ist außerhalb des explosionsgefährdeten Bereichs zu installieren.

Wenn der Signalstromkreis an einen Stromkreis der Zündschutzart EEx nL IIC angeschlossen wird, muss keine Sicherung vorgeschaltet werden.

Der Hersteller muss sicherstellen und dokumentieren, dass das Gehäuse des Gerätes einschließlich aller Kabeleinführungen je nach Verwendungsart entweder den Schutzgrad IP 54 oder IP 65 gemäß EN 60529 erfüllt.

Alle übrigen Angaben gelten unverändert auch für diese 1. Ergänzung.

<u>Prüfbericht:</u> PTB Ex 04-24290

Zertifizierungsstelle Explosionsschutz
Im Auftrag

Braunschweig, 9. Dezember 2004

Dr.-Ing. U. Johannsmeyer
Regierungsdirektor

SAMSON AG · MESS- UND REGELTECHNIK
Weismüllerstraße 3 · 60314 Frankfurt am Main · Germany
Phone +49 69 4009-0 · Fax +49 69 4009-1507
Internet: http://www.samson.de

S/Z 2005-02